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# Low Cost Cruise Missile Defense (LCCMD) Program

Lt Col Ed Gjermundsen  
DARPA/SPO



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# OUTLINE

- MOTIVATION
- THREAT
- PROGRAM DESCRIPTION
- TECHNICAL APPROACHES
- SUMMARY

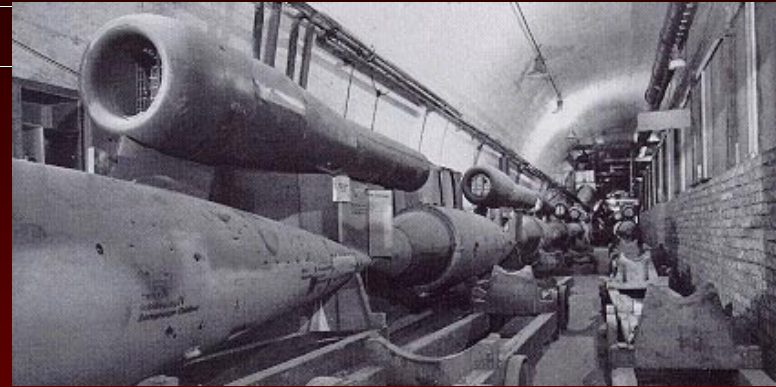


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# MOTIVATION

THEN...

- 30,000 Produced
- \$3K/unit



**GERMAN V-1**

NOW...

- 70,000 Worldwide
- \$150K-\$1M/unit



**MODERN CRUISE MISSILE**

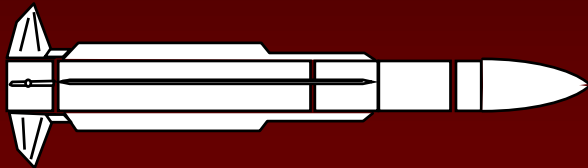


# US Air Defense

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**AMRAAM**



**Standard Missile**



**Patriot**

- **Cruise Missile Defense**
- **Ballistic Missile Defense**
- **Anti-Air Warfare**



# Cruise Missile Threat

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- 82 Countries Possess
- 75 Systems in Service
- 42 in Development



**Russian AS-11/KH-58**



**French Armat**



# UAV Threat

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- 74 Systems in Service
- 51 in Development



**CHEM/BIO WARFARE**



**INFO DOMINANCE**



**CONVENTIONAL WEAPONS**



# LCCMD Program

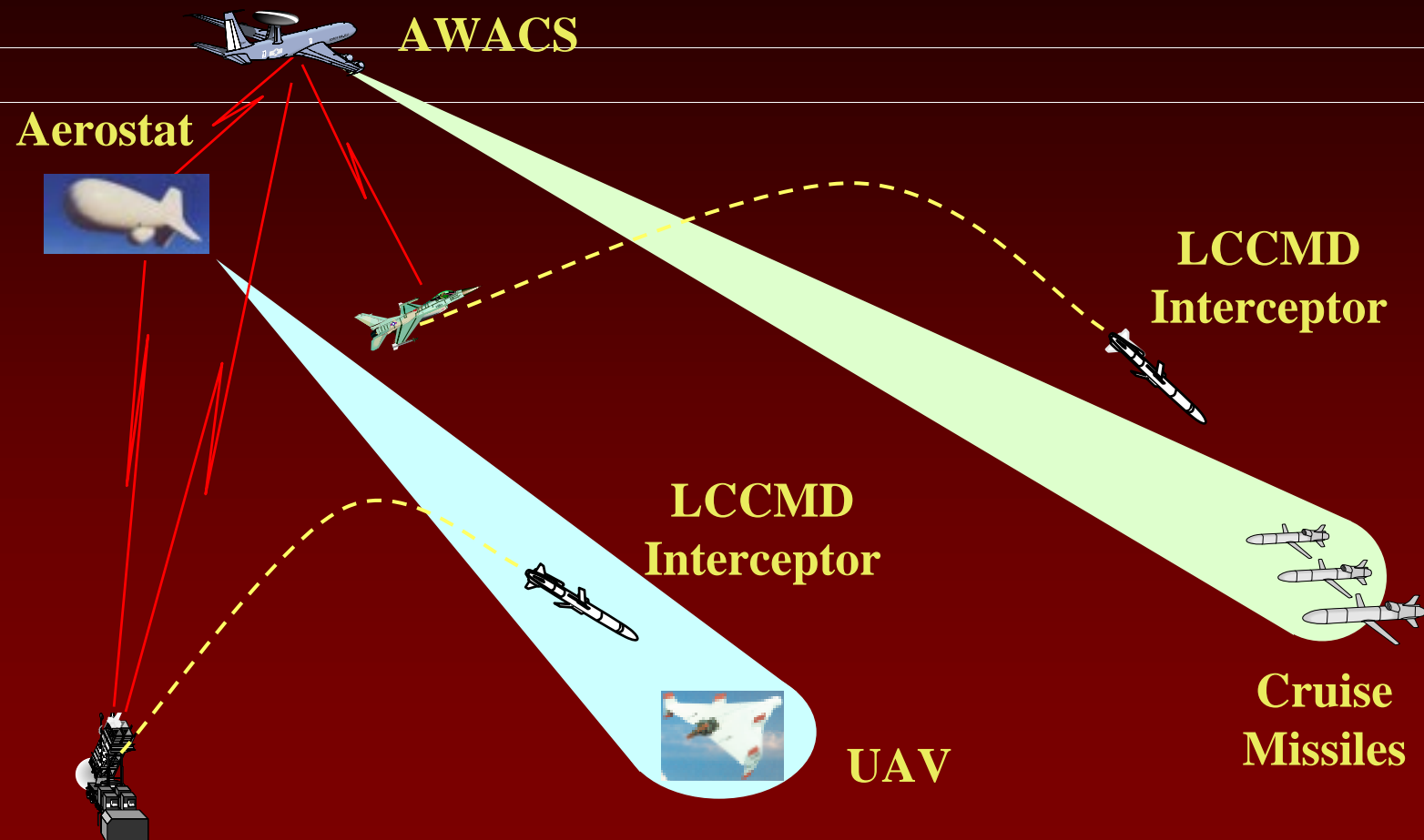
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- System Architecture Studies
- Seeker Concept Exploration
- Seeker Laboratory Demonstrations
- Seeker Ground Demonstrations
- Seeker Captive Flight Testing
- Seeker Live Fire Testing on MALD-Derivative Interceptor Vehicle



# LCCMD CONOPS

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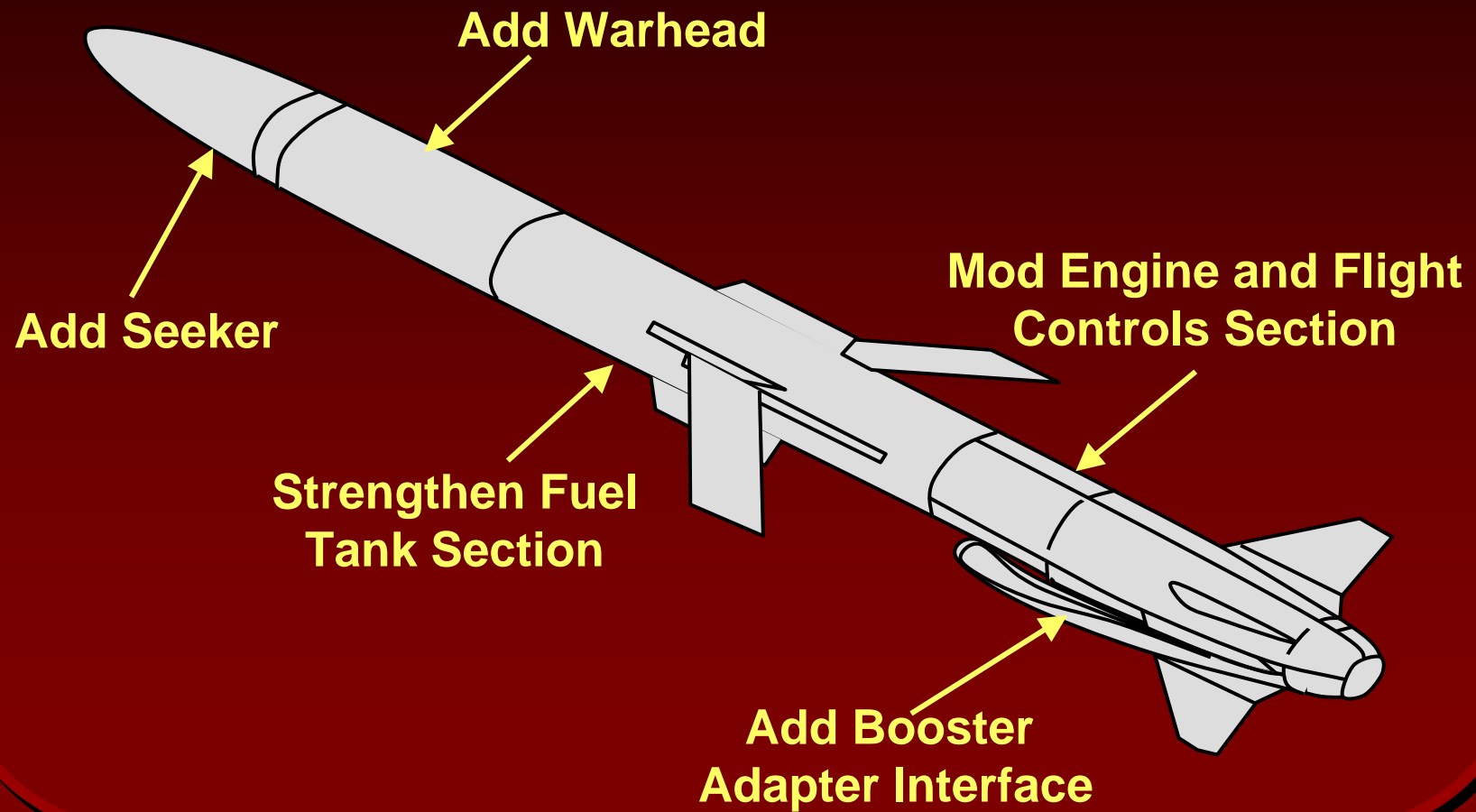






# MALD-Interceptor

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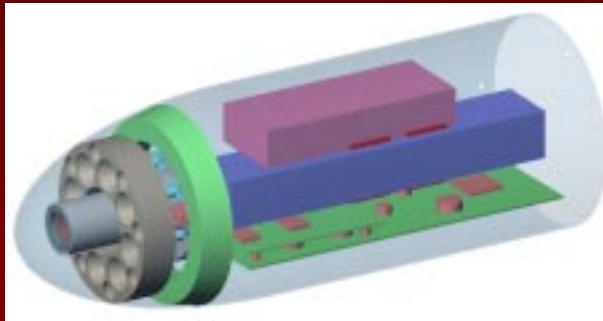
# Seeker Approaches

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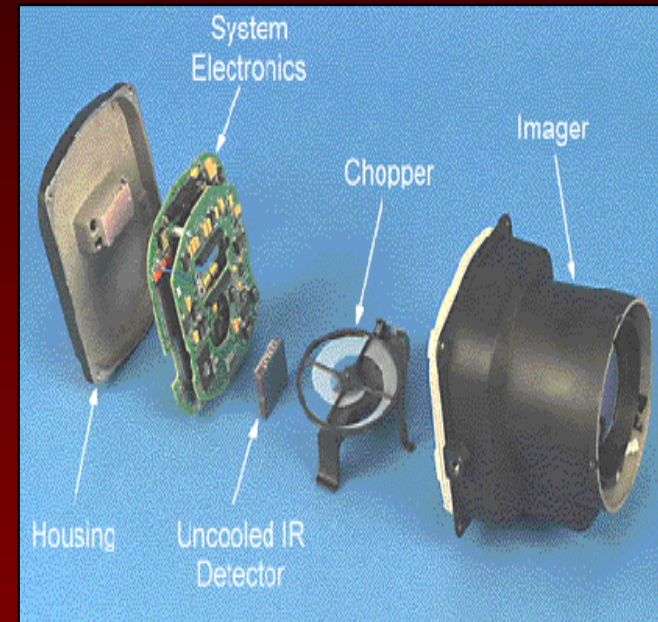
Front View



Side View



**Ladar Seeker**



**Infrared Seeker**



# Antenna Technologies *SPO*



**Optically Steerable  
Antenna**

**UHF Antenna**



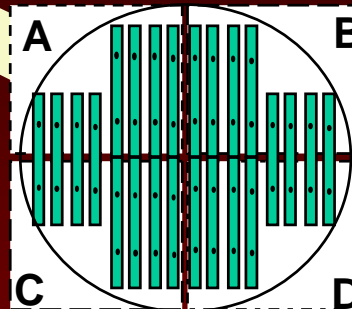


# MEMS ESA Seeker

*SPO*

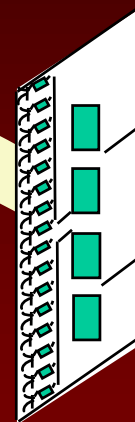


**MEMS  
ESA  
Seeker**

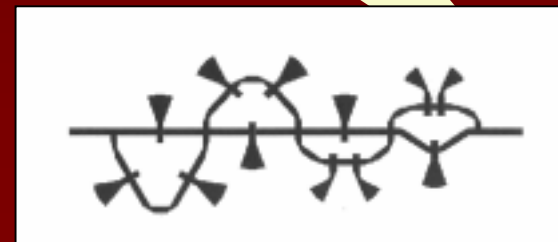


**ESA**

**Antenna Subarray**



**MEMS  
Phase  
Shifter**

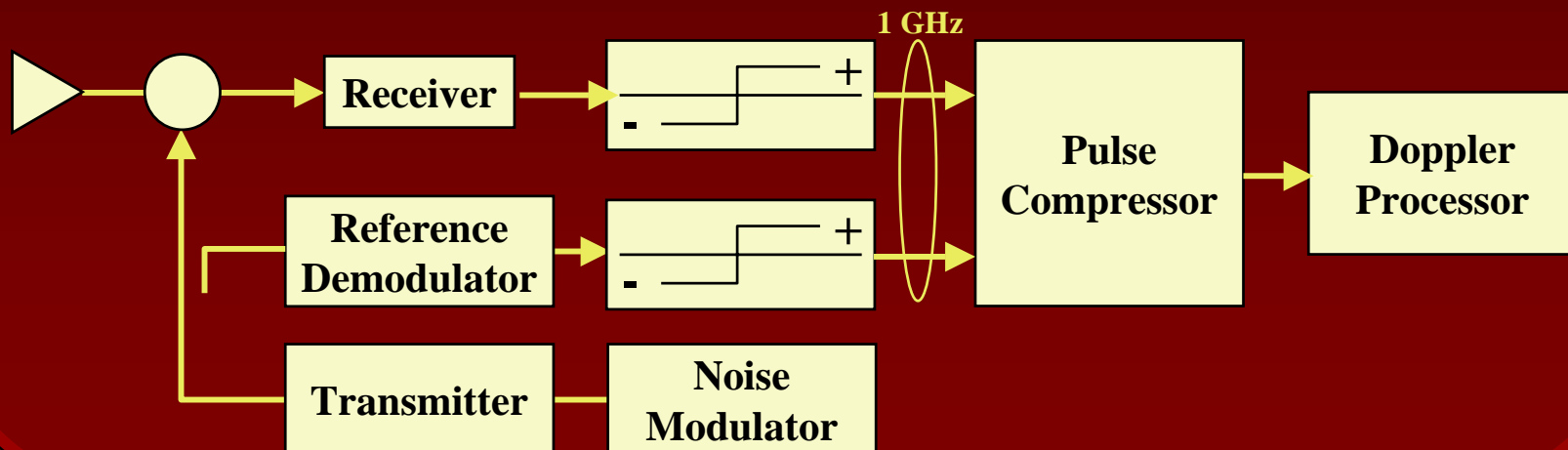




# Noise Radar Seeker

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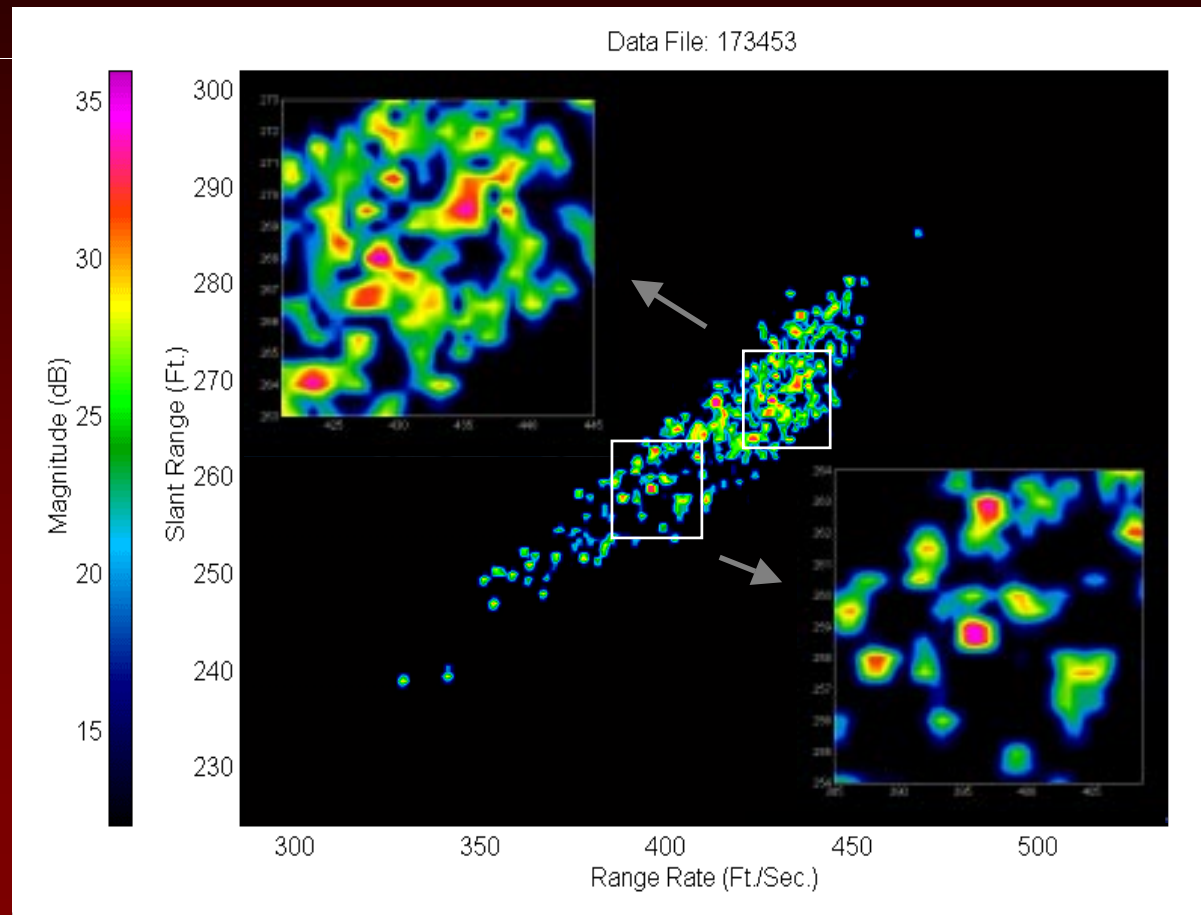
- Features: Extremely High Bandwidth, Jam Resistant, No Ambiguities
- Reduced Requirements: Antenna Sidelobes, H/W Stability, 1 Bit A/D
- Challenge: Signal Processor





# Noise Radar Imaging

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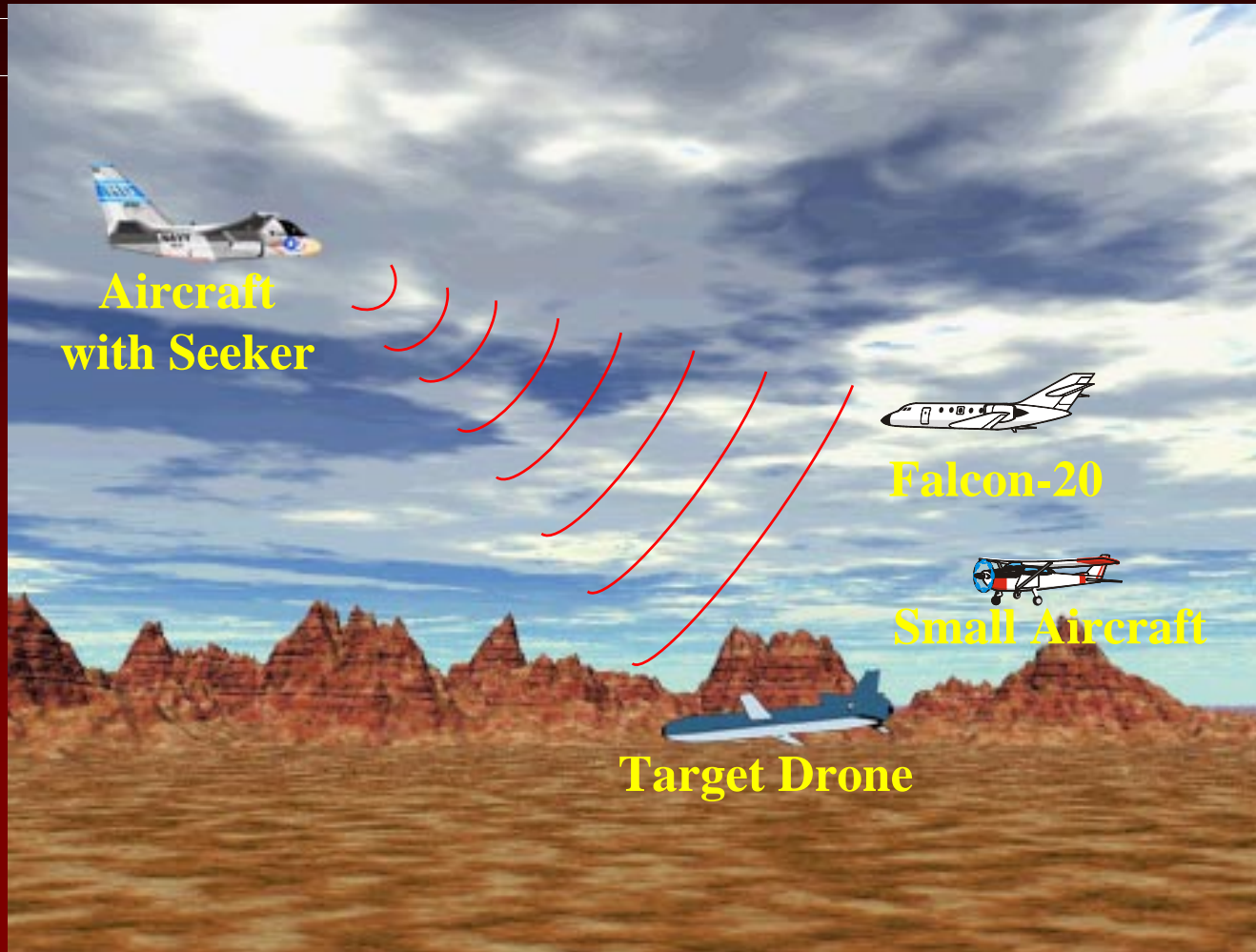






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# Flight Test





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# Summary

- Program Addresses Threat that Can Quickly Emerge
- Program Pursuing 6 Promising Concepts
- We Continue to Look for More Novel Approaches to Cruise Missile Defense and Technologies that Enable Multi-Mission Applicability